Ministry of Energy
Mines and Petroleum
Resources

ANNUAL REPORT

1982

BC

Honourable Stephen Rogers
Minister of Energy,
Mines and Petroleum Resources

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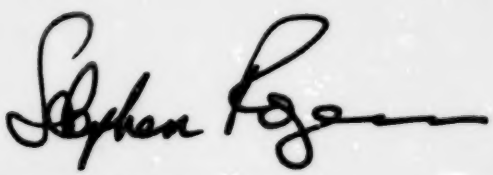
To the Honourable ROBERT GORDON ROGERS
Lieutenant Governor of the Province of British Columbia

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Ministry of Energy, Mines and Petroleum Resources for the years 1980, 1981 and 1982 is herewith respectfully submitted.



STEPHEN ROGERS

Minister of Energy, Mines and Petroleum Resources

Office of the Minister of Energy, Mines and Petroleum Resources

March 1984

Foreword

The first *Annual Report of the Minister of the Mines of the Province of British Columbia* covered the year 1874. Eighty-six years later, in 1960, *Petroleum Resources* was added to the title. In 1979, it became the *Minister of Energy, Mines and Petroleum Resources Annual Report*, and that was the last time an Annual Report was published by this Ministry until now.

This does not mean that information previously contained in Annual Reports was not available for the years 1980-1982. With the advent of modern data-gathering methods, more information and statistics were compiled than could fit comfortably into a single-volume Annual Report. This information, of vital interest to the mining and petroleum industries, was therefore provided in other annual publications covering the years 1980, 1981 and 1982: *Geological Fieldwork, Exploration in British Columbia, Mining in British Columbia*, the Mineral Resources Division's *Summary of Operations* and the Petroleum Resources Division's *Summary of Operations*.

In the push to produce these technically oriented documents, the more generalized Annual Report dropped out of sight. However that deficiency has now been remedied with the release of this volume, combining the Annual Reports for the years 1980, 1981 and 1982 under one cover.

Henceforth a general Annual Report will be issued every year, while technical information and statistics will continue to be made available in the other annual publications listed above.

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Introduction

The Ministry of Energy, Mines and Petroleum Resources administers British Columbia's mineral, coal, oil, natural gas and other energy resources. Its mandate embraces a wide range of responsibilities. At one and the same time, the Ministry promotes orderly development while encouraging conservation, provides services to industry while regulating its operation, ensures safety, protects the environment, collects revenue, formulates strategy and advises government.

In order to carry out its complex stewardship of the Crown-held resource, the Ministry has evolved into a highly professional organization of scientists, engineers, administrators, economic and public policy advisors, field technicians and support staff. At its head is the Deputy Minister, who reports to the Minister and through him to the government, the legislature and the people of British Columbia.

The Ministry consists of four divisions, each headed by an Assistant Deputy Minister: Energy Resources, Mineral Resources, Petroleum Resources and Finance and Administration. These divisions are broken down into specialized branches, which may be further subdivided into sections. This report follows the Ministry structure closely, as it reviews the years 1980, 1981 and 1982.

That was a period of great turmoil in world markets, and consequently a time of uncertainty for the mining, petroleum and energy industries of British Columbia. Nevertheless, revenues collected from these industries continued to be the greatest single source of income for the provincial government, and confidence in the future benefits to be derived from the province's resources has never wavered.

Revenue to the Crown

TABLE 1

DIRECT REVENUE TO THE PROVINCIAL GOVERNMENT FROM THE PETROLEUM AND MINERAL INDUSTRIES

	1980 $	1981 $	1982 $
PETROLEUM INDUSTRY:			
Crown reserves - disposition	181 266 804	60 776 966	16 724 133
Rental and fees	27 714 498	27 334 015	30 945 074
Crown royalties	49 369 549	57 038 394	76 180 767
B.C.P.C.:			
Net revenue from sales	244 168 144	158 000 000	155 000 000
MINING INDUSTRY:			
Claims, fees and rentals	7 971 635	4 860 320	3 860 320
Royalties	5 377 073	6 036 114	7 097 814
Mineral taxes	108 546 437	58 900 579	21 675 002
LAND SERVICE:			
Rentals and royalties	997 212	1 492 600	1 811 830
Total	**625 411 352**	**374 438 988**	**313 294 940**

Communications Branch

The Communications Branch is not included in the organizational structure of any of the four divisions, but reports directly to the Deputy Minister. It is responsible for communicating the Ministry's policies and programs to industry and the public. The branch also administers the Ministry library, which provides technical and scientific references and research assistance to Ministry staff, other government ministries and agencies, industry and the general public.

Requests to the Ministry for information should be addressed to:

Communications Branch
Ministry of Energy, Mines and Petroleum Resources
617 Government Street
Victoria, B.C.
V8V 1X4

Telephone (604) 387-5178

B.C. Hydro/B.C.U.C./B.C.P.C.

The Minister of Energy, Mines and Petroleum Resources is responsible for the British Columbia Hydro and Power Authority, the British Columbia Utilities Commission and the British Columbia Petroleum Corporation. These three Crown agencies produce their own annual reports which are presented to the legislature, and therefore are not dealt with in detail here. In brief:

- B.C. Hydro is the largest utility in British Columbia. It produces and delivers most of the electricity used in the province and exports surplus electric power to the United States. It also distributes natural gas in the Lower Mainland area and in the city of Victoria;

- the B.C. Utilities Commission regulates rates, standards and operations of public utilities, including B.C. Hydro. At the government's request it holds public hearings to examine proposed energy development projects or removals of energy resources from the province;

- the B.C. Petroleum Corporation's primary function is to market the natural gas produced in British Columbia by purchasing gas from producers and selling it to Westcoast Transmission Co. Ltd. Net revenue from these transactions is paid into the provincial treasury.

New Legislation 1980–1982

1980

In 1980 the *Energy Act* was repealed and replaced by the *Utilities Commission Act*. Amendments were made to the *Mineral Act* and the *Mineral Resources Tax Act*. Two sections of the *Mines Act* came into effect.

The *Utilities Commission Act* is a comprehensive piece of legislation which established the British Columbia Utilities Commission and empowered it to regulate public utilities as well as common carriers and purchasers in the petroleum industry. It superseded the *Energy Act* under which its predecessor, the B.C. Energy Commission, was established. The powers given to the new commission for general supervision over public utilities included power to: hold public hearings, conduct inquiries, employ staff, appoint supervisors and inspectors, control financing and fix rates.

Regulatory powers of the commission regarding the petroleum industry included the power to make orders in respect of operation of 'common carrier' pipelines carrying energy resources such as oil or natural gas. Similarly, the commission was empowered to establish conditions regarding 'common purchaser' aspects of such energy resources. Regulatory powers also extended to various aspects of retail sales of petroleum products.

An important dimension of the *Utilities Commission Act* was to create, in Part 2, the Energy Review Process under which government could regulate the construction and operation of major energy production, storage and transshipment projects as well as major energy use projects. This part of the Act also established powers for government to regulate the removal of energy resources from the province. Under Part 2 the commission would, on the request of the government, conduct hearings and make recommendations regarding project approvals.

Amendments to the *Mineral Act* included the repeal of Section 8 on prohibitory orders and its replacement by a section empowering the establishment of mineral reserves by regulation. The old provision was restricted to prohibition of location and recording on specified land. The result of the new section was a broader regulatory power to prohibit or otherwise control the

exploration and development of, or the location and recording of claims within, mineral reserves. The new section also added a provision for relieving the holder of a *Mineral Act* tenure which is within a mineral reserve, from work and fee obligations under the Act.

Other amendments to the *Mineral Act* increased the allowable size of a mineral claim group from 40 to 100. Section 40 was repealed and replaced. The new section changed the period for complaints to be brought, that a claim has not been located or recorded in compliance with the Act, from within two years to within one year of recording. The Chief Gold Commissioner was empowered to hear these complaints, instead of the minister.

Amendments to the *Mineral Resources Tax Act* included a new formula for calculating the return on capital deductible from gross proceeds. The amount of income exempted from taxation under the Act was raised from $20,000 to $50,000 and provision was made for optional payment of taxes by installment or lump sum.

Section 37 and 38(3) - (7) of the *Mines Act* was proclaimed in 1980. Section 37 created regulatory powers over mines, mining property, equipment and plants, and over mine safety. Section 38 defined offences under the Act and provided penalties for contraventions of the Act.

1981

In 1981, significant amendments were made to the *Mineral Land Tax Act* and the *Petroleum and Natural Gas Act*.

Definitions were clarified in the *Mineral Land Tax Act*. A term was added exempting mineral areas of less than 16.2 hectares from taxation under the Act. The scope of the agricultural mineral land classification was narrowed. Minor amendments were made improving the provisions for annual notices to owners of tax assessments. Provisions dealing with forfeiture for non-payment of taxes were clarified, a cash penalty of $50 was added and a power was created to give relief from forfeiture when it occurs through inadvertence or mistake. The fixed rate of interest imposed on unpaid taxes was also replaced by an annual rate prescribed by regulation.

Some definitions in the *Petroleum and Natural Gas Act* were simplified in 1981. Provisions that had allowed the holders of adjoining locations to make and file agreements for drilling near location boundaries were repealed. Also repealed was Part 6 of the Act which had dealt with natural gas licences, their issuance, renewal and terms. Separate petroleum leases and natural gas leases were eliminated, leaving only combined petroleum and natural gas leases. Exemption provisions were added for

regulations or special orders made under the Act. A new transitional section was added to permit holders of locations obtained before August, 1980 to apply to have the Act as amended apply to their location.

1982

In 1982 a new *Geothermal Resources Act* came into effect and amendments were made to the *Coal Act*, the *Petroleum and Natural Gas Act* and the *Utilities Commission Act*.

While the old *Geothermal Resources Act* had reserved to the Crown all the geothermal resources in the province, the new Act was more comprehensive. It provided for permit and lease tenures to be issued by the minister. Other provisions dealt with: location rentals and work requirements, authorization of well drilling and operation, royalties, unitization, regulatory powers and offences for non-compliance with the Act or with regulations.

Provisions were added to the *Coal Act* to permit the recording of documents affecting the disposition of *Coal Act* tenures. The terminology of Section 9 on assignments was simplified. A subsection was added to provide that a disposition was unenforceable unless in writing and signed by the transferor, or by an agent whose authority had been given in writing and recorded. Fixed licence and lease rental rates were eliminated in favour of rents prescribed by regulation.

Amendments to the *Petroleum and Natural Gas Act* included minor changes to definitions. Fixed fees and rentals for licences, leases and permits were replaced by fees prescribed by regulation. Statutory work requirements were replaced by sections empowering their prescription by regulation. Regulatory powers were also created for granting drilling licences and converting them to leases.

The *Utilities Commission Amendment Act* contained provisions permitting the consolidation of hearings on specified applications before the commission, and permitting single commissioners to sit alone when required to do so by the minister or the chairman of the commission. Section 27 of the *Utilities Commission Act*, dealing with persons generating power primarily for their own purposes, was modified to increase its flexibility and to allow for ministerial discretion in authorizing the sale of surpluses of such power.

The issuance by public utilities of shares under employee share and option purchase plans was exempted from requirements for commission approval of the issuance of public utility securities. Power to make orders approving the consolidation, amalgamation or merger of a public utility was shifted from the commission to the

Lieutenant Governor in Council. Section 61, which gave the commission authority over public utility share issuances that effect changes in control, was improved and made more comprehensive.

Part 4 of the *Utilities Commission Act* dealing with regulation of retail aspects of the petroleum industry was repealed, but this section remains unproclaimed. Provisions for proceeding before the Supreme Court to restrain contraventions of the Act, or orders or certificates issued pursuant to the Act, were consolidated into a single section. Powers were created for the revocation of orders, approvals or certificates where the holder has contravened their terms or the Act.

ENERGY RESOURCES DIVISION

Since its inception in 1980, the Energy Resources Division has served an important advisory function in the Ministry for all energy matters. While the Petroleum Resources Division is responsible for the direct supervision of industry-related operations in the petroleum industry, the responsibility for overall energy policy in the province is now handled by the Energy Resources Division. Division staff provide technical advice to the minister and government agencies and carry out energy research, policy analysis and evaluation of major energy projects. The division also provides educational and other special programs designed to help the province increase energy independence through conservation and use of renewable energy resources.

The activities of the division are carried out by four branches. The Policy Development Branch provides the focal point for development of overall energy strategies for the province. The Project Analysis Branch is responsible for reviewing the many factors that affect large-scale energy projects such as major hydroelectric dams. The Forecasts and Special Projects Branch estimates future provincial energy consumption levels and carries out major studies, such as the determination of British Columbia's natural gas surplus. The Conservation and Renewable Energy Branch manages a wide range of practical programs which help improve energy efficiency in the province.

Policy Development Branch

The Policy Development Branch has the primary objective of designing energy strategies to meet the continuing energy needs of British Columbia. It also provides the capability to respond quickly to emerging short-term energy issues.

In February, 1980, the Ministry released an Energy Policy Statement which specified: a stewardship role for the Ministry in energy matters; building on the province's considerable energy strengths; providing a streamlined energy review process; expanding conservation efforts; providing sound information on surpluses and exports; establishing responsible energy pricing; intensifying research and development; and coordinating energy and industrial development.

The Policy Development Branch maintains extensive communication with federal, other provincial and interprovincial agencies. This important function of the branch has helped bring about agreements on Alberta/B.C. natural gas pricing and export policies as well as the 1982 Canadian Oil Substitution Program (COSP). The branch has represented the province in public hearings before the National Energy Board in matters ranging from applications by Westcoast Transmission for looping of their natural gas pipeline system to reviews of energy supply and demand. In 1980, the branch appeared before the Parliamentary Committee on Alternative Energy.

In 1981, industry expressed considerable interest in processing British Columbia's natural gas resources. The minister recognized that the potential demand for these resources far exceeded their estimated supply. The Natural Gas Allocation Process was initiated in June, 1981 to appraise the gas volumes considered surplus to British Columbia's requirements and to call for competing proposals for the use of this surplus.

The branch developed criteria to ensure maximum benefit to the province from the use of this natural gas. Thirteen proposals were received in December, 1981 for projects including production of petrochemicals, liquefied natural gas (LNG), ammonia/urea fertilizer and methanol, as well as pipeline exports. Each proposal was evaluated for its employment potentials, impacts and net economic benefits. In July, 1982, the Minister allocated three

trillion cubic feet of surplus natural gas to these three projects:

- 800 billion cubic feet to the Dome Petroleum-sponsored Western LNG project,
- 1,800 billion cubic feet to Westcoast Transmission for U.S. exports after 1989, and
- 400 billion cubic feet to a future ammonia/urea fertilizer project.

A staff paper outlining the technical analysis of this decision was issued in October, 1982.

In September, 1982, the branch concluded negotiations with the federal government leading to an agreement on the pricing and taxation of oil and gas. Under this agreement, the Government of Canada agreed to forgive its excise tax on export sales of natural gas and pay the whole cost of the Petroleum Incentive Program. British Columbia agreed to pay outstanding taxes accrued by B.C. Hydro and the B.C. Petroleum Corporation. The agreement provided for oil and gas revenues to be alloted 26 per cent to Canada, 37.4 per cent to British Columbia and 36.6 per cent to the oil and gas industry.

Negotiations with Canada also led to agreements on the terms of federal funding under the natural gas Distribution System Extension Program (DSEP). In 1982, a study group was formed to review the system of developing and marketing natural gas both within and outside British Columbia.

The Policy Development Branch participated in all three phases of the National Energy Board's 1982 Gas Omnibus Hearings into the availability of natural gas for export. The main thrust of the branch's intervention was to provide support for future exports of British Columbia gas identified through the Natural Gas Allocation Process.

An interprovincial task force chaired by the branch in 1982 submitted a report to the Council of Energy Ministers. This report outlined potential oil demand restraint measures to be implemented in the event of an oil shortage. The minister was given the power to declare an energy emergency when the social and economic well-being of the province is endangered by an actual or anticipated shortage of an energy resource.

A major initiative was introduced in the fall of 1982 with the formation of a group empowered to study the marketing of British Columbia gas. The study group's mandate was twofold: to conduct a broad review of the systems of developing and marketing gas; and to make specific recommendations designed to stimulate exploration, development and marketing of British Columbia's natural gas. This work was still in progress at the end of 1982.

Project Analysis Branch

The Project Analysis Branch coordinates the review of major proposals for the development, use and removal of the province's energy resources. *The Utilities Commission Act* of 1980 requires that large-scale energy generating plants, transmission lines, pipelines, transshipment or storage facilities and energy removals from the province must be in the public interest. The branch recommends on the disposition of these applications to the Minister of Energy, Mines and Petroleum Resources who, with the concurrence of the Minister of Environment, makes final determinations.

The Project Analysis Branch was established in October, 1980, with full operations under way in early 1981. The first major project referred by the ministers to a public hearing was B.C. Hydro's application to build a hydroelectric generating station at 'Site C' on the Peace River. The branch coordinated inter-ministry reviews and developed terms of reference for a public hearing into the application. The ministers issued the terms of reference in spring of 1981 with the Utilities Commission initiating the hearing later in the year. It concluded in autumn of 1982.

The branch produced two key documents in 1981 that detail the energy project review process.

The Energy Review Process: Guide to Agencies outlines the operating framework of the process. This helps ensure that reviews can be streamlined while still allowing consideration of all relevant economic, social and environmental factors of projects. The guide describes the way relevant provincial agencies can most efficiently participate in a coordinated and comprehensive assessment of major projects.

The *Guide to the Energy Project Review* was produced to assist applicants in the process of applying for an Energy Project Certificate. The guide outlines the steps applicants should take in order to meet legislative requirements. It helps ensure that required supporting studies are appropriate and cost-effective.

In April, 1982, the minister called for proposals to transmit natural gas to Vancouver Island. Eight submissions for either pipeline transmission or LNG shipment were received. The branch actively participated in the initial assessment of these proposals in preparation for public hearings.

Late in 1982, staff of the branch advised the Ministries of Environment and Intergovernmental Relations on the energy and financial aspects of negotiations with the City of Seattle regarding flood impacts on the Skagit Valley.

The Project Analysis Branch has also coordinated review work of numerous other major projects including:

- the Cranbrook-to-Alberta border 500 kv transmission line,
- the Kelly Lake-to-Nicola 500 kv transmission line,
- the Alaska Highway Natural Gas Pipeline proposal,
- the Aluminum Co. of Canada's proposal to add new generating capacity at Kemano,
- the Western LNG proposal by Dome,
- and several proposals by B.C. Hydro regarding generating and transmission capacity.

Forecasts and Special Projects Branch

It is the responsibility of the Forecasts and Special Projects Branch to provide the ministry with short- and long-term forecasts of energy prices and consumption. Forecasts of each energy type are made for provincial and export markets. The branch is also required to carry out major special projects which help develop short- and long-term energy strategies. These projects require the branch to conduct in-depth research and analysis of complex energy issues.

The Forecasts and Special Projects Branch was created in 1980 when the Energy Resources Management Division of the British Columbia Utilities Commission was transferred to the Ministry. Branch staff prepared a 15-year *British Columbia Energy Supply and Requirements Forecast* and issued a *Summary Report* of this forecast in the summer of 1981. The summary projected a base-case rate of increase in energy use in the province of 1.7 per cent per year over the 15-year period reported. This was a rate of increase moderately lower than had been previously forecast. The branch concluded that British Columbia's energy resources will be sufficient to meet provincial energy demand, provided the bulk of liquid hydrocarbon requirements continues to be imported. The 1981 forecast was submitted as evidence and defended in cross-examination during the B.C. Hydro 'Site C' hearings in the fall of 1981.

The branch initiated development of an econometric energy demand forecasting model in 1981. This model makes energy demand forecasting more reliable and sophisticated than previously possible.

The Natural Gas Allocation Process launched in 1981 required a volume appraisal of gas supplies surplus to British Columbia's requirements. Staff members of the branch were assigned to assist the Commissioner Inquiry on British Columbia's Requirements, Supply and Surplus of Natural Gas and Natural Gas Liquids. In May, 1982, the branch published the results of the inquiry. The report recommended a two-part surplus determination procedure: an 'extended reserves test' which gives the total surplus available at any point in time, and a 'producibility test' which indicates when the total surplus will actually be produced.

The inquiry used the extended reserves test to determine that British Columbia had a surplus of 60 billion cubic metres (2.1 Tcf)

as of January 1, 1982. It was projected that the total available surplus would increase to levels between 81 billion cubic metres (2.9 Tcf) and 121 billion cubic metres (4.3 Tcf) in 1990, assuming a favourable economic environment.

The producibility test determined that the surplus could be produced at rates of approximately 2 billion cubic metres (70 Bcf) per year or less until 1990. Beyond this date, with the expiration of Export Licence GL-41 issued by the National Energy Board, the surplus could be produced at rates in the range of 5 to 10 billion cubic metres (177 to 353 Bcf) per year, depending upon the level of drilling activity.

Eight proposals to serve Vancouver Island with natural gas were received in reply to the Minister's request in April, 1982. Assessment of the technical and economic feasibility of bringing gas to Vancouver Island was begun in the fall of 1982 by a team of consultants and branch staff.

Conservation and Renewable Energy Branch

The Conservation and Renewable Energy Branch was established to promote energy efficiency and to manage the development of renewable energy resources in the province. Its responsibilities include administering information programs, demonstrating energy projects and undertaking energy conservation studies.

Through the Canada-British Columbia Conservation and Renewable Energy Demonstration Agreement (CREDA), initiated in 1979, $27 million was allocated for development of cost-effective energy conservation and renewable energy technologies. Major projects included:

- small-scale hydroelectric generation demonstrations in remote locations;
- solar hot water demonstration projects to evaluate areas where sufficient solar energy would make such systems cost-effective;
- installation of active hot water systems at the Granview multi-family co-op and the University of Victoria;
- conversion of the high temperature lime kiln at a MacMillan Bloedel pulp mill from a conventional fuel system to a system using a 'wet-cell' wood waste burner.

Other important undertakings of the branch during 1981 and 1982 included:

- the Energy Audit Program, which provided computerized on-site energy analysis for major energy users;
- development and distribution of informational and educational publications and programs relating to energy conservation;
- the Energy Van, a mobile energy education program for use in the public school system;
- establishment of Energy Information Centres in demonstration buildings in major communities;
- displays at public exhibitions on energy efficiency in housing and renewable energy;
- seminars and workshops for government and commercial sectors.

MINERAL RESOURCES DIVISION

The Mineral Resources Division oversees the operations of British Columbia's extensive mining industry and facilitates the orderly development of mineral, coal and aggregate resources in the province. This responsibility includes: providing technical safety inspection at minesites, advising the minister and government agencies on the economic impact of mineral taxation and regulatory policies, aiding the mineral industries with geological surveys and an appropriate data base, protecting mineral lands from alienation, and administering tenure on mineral lands.

The division is structured into four branches. The Inspection and Engineering Branch provides technical monitoring of open-pit, underground and placer mining operations to ensure the safety of the public and of workers employed in the industry. The Geological Branch provides the scientific surveys and studies necessary to assist both mineral and coal exploration as well as provincial regulation of mineral and coal production. The Mineral Policy and Evaluation Branch undertakes economic analyses of the mineral industry to allow the government to formulate tax and regulatory policies. The Mineral Titles Branch collects and maintains all records covering claims to mineral resources.

The mining industry report which follows outlines the state of the industry and the Ministry's relationship to it during the period of 1980-1982. It also lists the levels of mineral production and the revenue generated by the mining industry during this period.

The Mining Industry 1980–1982

The total value of solid mineral production in British Columbia established record levels in 1980. Declining world metal prices in 1981 caused this total value to decrease despite increased industry production. Substantially reduced world demand for end use products which require minerals sent prices for mineral commodities plummeting in 1982. Manufacturing and construction industries using mineral resources were particularly hard hit by the general economic recession and high interest rates in 1981 and 1982.

British Columbia is Canada's largest producer of copper, molybdenum and coal. Of these three, coal production value was the only major provincial mineral commodity value to gain in strength between 1980 and 1982. Provincial copper production fell as copper prices dropped to the lowest levels in modern history. Molybdenum mining in British Columbia was badly hurt by weak demand from the steel industry.

World mineral producers glutted the market with their commodities during 1981 and 1982 in spite of falling prices. A combination of oversupply and falling prices caused mineral resource production and employment to be cut back considerably in the province. Very few provincial mining companies avoided losses on their operations in 1981 and 1982.

Exploration for precious metals and coal was at high levels in 1982, suggesting that the industry continues to regard the province as a favourable place for investment. Coal revenues were expected to show significant increases when northeastern coalfield operations began production in 1983.

Table 2 on page 35 summarizes the total value, production and provincial revenues produced by the mining industry in 1980-1982.

Metals

Total value of metal production in 1982 was $1.057 billion compared with $1.246 billion in 1981 and $1.429 billion in 1980. Following is an outline of the performance of the province's major commodities during 1980-1982.

Despite a decline in copper prices from an average of $2.53 per kilogram in 1980 to $1.77 per kilogram in 1982, this commodity remains the most important metal in the provincial mineral sector. Overall production capacity increased from 264 million kilograms in 1980 to 290 million kilograms in 1981. Production fell to 279 million kilograms in 1982 as a result of shutdowns by several mining operations.

Only a minor portion of the copper concentrates produced in the province are smelted here, with about 94 per cent of the material shipped to Japan and other world markets. Lornex Mining Corp. Ltd. completed an expansion program at its Highland Valley mine in 1981, making it the largest capacity base metal mine in Canada.

Molybdenum markets were exceptionally strong in 1980, with provincial levels of production at 11.2 million kilograms. Production increased to 12.9 million in 1981 and to 14.8 million kilograms in 1982, but a reduction in price from $25.78 per kilogram in 1980 to $15.33 per kilogram in 1981 resulted in a drastic decline in the value of this production. Faced with mounting losses, primary molybdenum producers in B.C. began to reduce mine production. Several operations slowed down or closed indefinitely in the last half of 1982. With no strengthening of prices in sight, the industry will be considerably reduced by these closures.

Europe is the primary destination for provincial molybdenum production, with Japan and the United States sharing the majority of the remaining production. Porphyry deposits have been the major targets of molybdenum exploration, with Craigmont Mines Ltd. and 20th Century Eagle Corp. carrying out major drilling programs in 1980 and 1981.

Gold increased production from 7.5 million grams in 1980 to 7.8 million grams in 1981, but 1982 production slipped to 7.7 million grams. There was a 23-per-cent drop in the price of gold in 1981, but gold prices remained stable through most of 1982 with a strong recovery in the fourth quarter.

Silver production also increased significantly between 1980 and 1982. From 203 million grams produced in 1980, silver production set historical records of 403.7 million grams in 1981 and 497 million grams in 1982. The gross value of the metal was at disappointing levels as silver market prices decreased by 50 per cent in 1981. The opening of the Equity Silver mine near Houston in 1981 accounted for a significant share of silver production increases.

Precious metals were a major component of the province's exploration programs in the three years, reflecting high prices paid for the metals and a relatively short lead time required to bring properties into production. Major exploration areas have

included the Coquihalla area, the Toodoggone area, the Queen Charlotte Islands and the West Kootenay districts of Tillicum Mountain and Greenwood Camp.

Zinc and lead production in the province increased in 1981 from 1980 levels, but production declined marginally in 1982. This reduction reflects the mid-1982 temporary shutdown of Cominco's Sullivan mine and Trail smelter.

The Cominco smelter at Trail is the world's largest lead-zinc production complex. Most of the lead-zinc concentrates produced in the province are smelted and refined here. The Trail smelter continued its $400 million expansion and modernization program during 1980-1982.

Zinc prices increased slightly in 1981 and remained stable through 1982, while lead prices continued on a downward trend during this period. The reduction of lead prices reflected the decline of lead used in battery production. Westmin Resources' expansion of its Buttle Lake mine should increase provincial lead and zinc production in 1984.

Coal

Coal displaced copper commodities in 1982 as the most valuable solid mineral produced in British Columbia. The value of coal production increased from $461.5 million in 1980 to $544.2 million in 1981 and $566.8 million in 1982.

Although coal is widely distributed in the province, the largest coal operations were in the southeast Crowsnest Coalfield, which produced over 90 per cent of total provincial production. The Bulkley Valley Colliers Ltd. mine at Telkwa was a minor producer of thermal coal. B.C. Coal Ltd., a subsidiary of the B.C. Resources Investment Corp. (BCRIC), was the province's largest producer. Together, B.C. Coal and Fording Coal Ltd. produced most of the province's coal. Major coalfields in the northeast section of the province were scheduled to begin production in late 1983.

Japan was the largest market for British Columbia coal, with purchases of over 7 million tonnes in 1980 and 6.7 million tonnes in 1981. In 1982, Japanese steel works cut back their requirements from British Columbia by 25 per cent. Both B.C. Coal and Fording Coal operations were suspended for short periods of time to accommodate this reduction.

Diversification of coal markets continued during 1980-1982 with substantial increases in sales made to Korea, Brazil, Spain, Denmark and Italy. Coal sales were also increased to Canadian markets. Coal exploration programs continued at fluctuating levels between 1980 and 1982 as a result of drilling programs that matured

and properties that entered the development phase. A total of $15.5 million was spent on coal exploration in 1980. This figure increased to $35.4 million in 1981 and dropped to $11.7 million in 1982 as development of northeast coal intensified. Gulf Canada remained the leader in coal exploration programs during 1980-1982. Most of the exploration activity took place in northeast coalfields.

The major development projects between 1980 and 1982 were Denison Mines Ltd.'s Quintette and Teck Corp.'s Bullmoose projects in the northeast. Major construction activity continued through 1981 and 1982 at these sites and the adjacent townsite at Tumbler Ridge.

Two major new mines also began operating in the southeast in 1982. Crows Nest Resources' Line Creek mine and B.C. Coal's Greenhills operations began open-pit production of both metallurgical and thermal coal.

Industrial Minerals

The value of industrial minerals produced in the province climbed from $115.9 million in 1980 to $122.4 million in 1981. This value declined to $95.6 million in 1982 owing notably to the reduction of asbestos production from the Cassiar mine.

While asbestos continued to be the province's most valuable industrial mineral produced between 1980 and 1982, there was a significant growth in the value of sulphur produced during this period. Sulphur is produced as a by-product from Cominco Ltd.'s roasting operations and Petrosul International Ltd.'s sour gas production in the Peace River area.

Westroc Industries Ltd.'s Windermere mine produced most of the province's gypsum from 1980 to 1982. Production of barite came mainly from Mountain Minerals Co. Ltd.'s two small underground mines in the East Kootenays and the smaller Baroid of Canada Ltd. operation at Golden. Barwell Resources' barite mine near Windermere came on stream in 1981, adding significantly to barite production capacity in British Columbia. There were numerous provincial producers of crushed or ground rock products, but production was dominated by the International Marble and Stone Co. Ltd. operation at Nelson. Many other industrial minerals were produced by small mining operations; most of these operations had production values of $100,000 or less.

Significant exploration and development for industrial minerals during 1980-1982 was conducted by Eaglet Mines Ltd. for fluorite near Quesnel Lake and Baymag Mines Co. Ltd. for magnesite near Radium Hot Springs. There was also continued underground exploration of the McDame orebody by Cassiar Resources.

Structural Materials

Most structural materials in British Columbia are produced near major urban centres and are consumed by the construction industry. The production value of these materials fell from $242.3 million in 1980 to $200.8 million in 1981 and $164.1 million in 1982, reflecting the decline in construction during this period.

Sand, gravel and cement accounted for more than 80 per cent of structural material production in the province. Other important structural materials included limestone, clay products, riprap, crushed rock and building stone. Many of these products were produced at a large number of small quarries, some of which had very intermittent production.

Northwest Mineral Development

In 1981 and 1982, staff of the Mineral Resources Division participated in a major study for the Cabinet Committee on Economic Development. This study examined the large-scale mineral development opportunities of the rich mineral resource base in the northwest section of the province.

An Inter-Ministry Task Force began a series of more detailed follow-up studies in 1982 on the scale and timing of potential mineral development in the region. A general framework for future development of significant mineral deposits was established. The Kutcho Creek, Mount Klappan and Schaft Creek/Stikine resource areas were closely studied for possible major mine developments over the next 20 years.

The Ministry's Mineral Resources Division expects to be closely involved in future discussion and planning for development of the region.

TABLE 2

VALUE OF PRODUCTION

	1980 $	1981 $	1982 $
Metals	1 429 002 180	1 246 682 535	1 057 488 380
Coal	461 492 857	554 271 292	566 878 240
Structural Materials	242 325 657	200 786 479	164 156 644
Industrial Minerals	115 926 007	122 464 842	95 544 218
Total	**2 248 746 701**	**2 124 205 148**	**1 884 167 482**

PROVINCIAL REVENUE FROM THE MINING INDUSTRY

	1980 $	1981 $	1982 $
Claims	3 492 635	4 178 169	3 860 320
Coal licences and rentals	4 479 000	3 128 752	2 954 387
Coal royalties	5 228 891	6 011 820	7 097 772
Iron ore royalties	148 182	24 295	45
Mineral land taxes	10 403 808	10 999 205	13 989 511
Mineral resource taxes	79 861 651	32 153 394	1 136 895
Mining taxes	18 460 978	15 747 983	6 378 279
Rental and royalties on industrial minerals and structural materials	997 212	1 492 601	1 811 830
Total	**122 892 357**	**73 736 219**	**37 229 037**

Inspection and Engineering Branch

The Inspection and Engineering Branch has the responsibility to ensure that the maximum possible recovery of natural resources from mining operations is achieved while keeping personal injury and environmental disturbance to a minimum. To do this, the branch maintains a network of district offices staffed by experienced professional personnel and supported by specialist engineers based in Victoria.

On a regular basis, staff members conduct safety and engineering inspections at all metal mines, coal mines, sand and gravel pits, placer mines and quarries throughout the province.

The branch further ensures that every employee working in an underground or open-pit operation is under the supervision of a person holding an appropriate supervisor's certification. Examinations are administered to ensure that supervisory candidates meet the required standards of training and education. Certificates for miners, coal miners and blasters are also issued from the district offices.

Mechanical/Electrical Section

Trained engineers and technicians are required to ensure that specialized equipment used in the mining industry is safe and conforms to Ministry standards. The Mechanical/Electrical Section is responsible for routine mechanical and electrical approvals, and for such inspections as are necessary for the safe operation of equipment. Staff members make additional detailed engineering evaluations and inspections of all mobile equipment over 50 tonnes and all other equipment which has innovative or special design features. Such equipment would include: large haul trucks, loaders, shovels, drills and cranes, as well as specialized flame-proofed equipment for use at underground coal mines.

Staff members work in close cooperation with industry, manufacturers, engineers and contractors. Members have spent considerable time reviewing design drawings, manufacturing specifications and final installation plans for several mine hoists. They were also in attendance at the commissioning of these installations which involved both drum and friction-type hoists.

The designs of several diesel-powered vehicles have undergone intensive engineering reviews and tests prior to their acceptance for use in underground coal mines within recent years. In one particular case, some of the most advanced engineering techniques available were incorporated into the design of such a vehicle by the manufacturer after receiving input from both the mine purchasing the vehicle and from members of the section. Staff engineers and technicians closely monitored this vehicle's performance in order to ensure its subsequent safe operation in the underground coal environment. Several additional models of this vehicle were later put into operation following Ministry approval of the original unit.

Manufacturers continued to introduce both new and adapted versions of large haul trucks. All new models of over 50 tonnes gross vehicle weight are subject to rigorous engineering reviews before they can qualify for use at mining operations. A recent trend has been to all-hydraulic braking, rather than the air/hydraulic braking previously used extensively on these vehicles. This has required the section to ensure that such designs would not compromise other dependent systems essential to the overall safe operation of the vehicle. Physical testing of these large vehicles is conducted under mine site conditions, and braking performances during high-speed downhill tests are closely monitored and evaluated by staff members.

The section has continued to represent the Ministry on the Mobile Equipment Committee of British Columbia. This federal-provincial committee attempts to provide both manufacturers and purchasers of mobile equipment with an accelerated means of gaining approval for equipment, irrespective of which authority will regulate its future use.

Section members have also continued to participate in the work of the Canadian Standards Association, with representation on technical committees preparing standards for the use of diesel-powered equipment in underground coal mines, for the use of fire-resistant fluids in underground mines, and for the use of electricity in mines.

Geotechnical Section

In 1980 the Ministry established a separate section responsible for regulating impoundments, minesite runoff and concentrator tailings. Serious personal and environmental damage can result from a failure of such enclosures. A specialized geotechnical engineer now handles these important functions. His responsibilities also include inspecting slope stability at pits and dumps, as well as other special problems involving haul roads or water diversions at mining operations.

Geotechnical engineering combines geological concepts with engineering practices for evaluation purposes. The Ministry's geotechnical inspector assesses the mechanics of soil and rocks that go into the design of foundations, embankments and other mine site structures.

In its first full year of operation, the section put its main emphasis on inspecting the major tailing impoundments in the province. Inspections of geotechnical features at 25 mining projects were conducted in 1981. Further inspections of pit walls and dump slopes at many of the open-pit mines in the province were also made. Ten approvals of new or significantly modified existing tailings ponds were recommended in 1981; a limitation was ordered on one insecure facility. Four new or modified pits and/or dumps, as well as four water-controlling schemes at mines, were also approved.

In 1982, the emphasis of the section moved to approving stability-related submissions. While only 12 mining projects were visited for inspection during the year, a total of 27 applications for approval were reviewed.

Only minor problems at two of the 25 active tailing impoundments in British Columbia occurred during 1981 and 1982. There were, however, two major failures of waste dumps in 1982. Fortunately, no loss of life or appreciable damage resulted.

The mining industry has generally demonstrated an awareness of geotechnical problems and has shown a willingness to deal with these problems in ways acceptable to the Ministry.

Reclamation Section

Lands used for mining, mine waste disposal or mineral exploration in British Columbia are required to be restored to a useful purpose compatible with appropriate land-use values. The Reclamation Section is responsible for ensuring that any lands disturbed by mining since 1969 are reclaimed and revegetated. The Ministry requires that prior to any surface disturbance at a worksite, a reclamation permit be issued and a security deposit be retained until a reclamation program is adequately completed. Permits are issued for: metal mines, mineral exploration, coal mines, coal exploration, sand and gravel pits, quarries and placer mines.

Vegetation studies are conducted at operating mines, with their results computerized and published for the benefit of the mining industry. A booklet entitled *Guidelines for Mineral Exploration* was published in 1982. These guidelines outline the requirements for conducting provincial mineral exploration in compliance with mining legislation.

Between 1980 and 1982, the Ministry funded several land use studies and research projects. One successful project was completed at the Granby tailings pond at Princeton, where alfalfa production on 12 hectares under irrigation was increased threefold.

The annual B.C. Mine Reclamation Symposium, jointly sponsored by the Ministry of Energy, Mines and Petroleum Resources and the Mining Association of British Columbia, was successfully continued during 1980-1982. Presentations on many aspects of land reclamation were made to industry and government agencies. Topics during this period covered waste dump management, soils and fertilizers, and reclamation in mountainous areas.

During these three symposia, B.C. Mine Reclamation Awards were presented to Fording Coal Ltd. for its reclamation work within the Fording Valley, to Utah Mines Ltd.'s Island Copper operation for its reclamation and research program, and to Crows Nest Resources for outstanding achievements at its Line Creek operation.

Mine Rescue and First Aid Section

The Ministry's responsibility to protect the lives of mine employees includes maintaining local mine rescue stations. Six provincial stations have been established as mobile rescue units in Fernie, Nanaimo, Kamloops, Smithers, Nelson and Prince George. Each station is able to transport rescue equipment anywhere within its region should an emergency occur.

The stations carry sufficient self-contained (oxygen-supplying) breathing equipment to maintain two underground rescue teams of six men each. Type 'N' gas masks, gas detectors, oxygen therapy and first aid equipment are also carried by each station for underground auxiliary support.

To support mine rescue in open-pit mining operations, the stations are equipped with the necessary stretchers, ropes and other apparatus, including equipment needed for avalanche rescue operations. The Ministry may occasionally lend equipment to mining companies to supplement what the companies already have.

District mine rescue training coordinators make regular visits to mining operations in the province to inspect rescue equipment and first aid facilities. Coordinators also provide training in underground and surface rescue courses, including survival first aid. During 1980-1982 the Mine Rescue and First Aid Section examined hundreds of mine employees in these courses. To keep abreast of technological change, the *General Underground Mine Rescue Manual* was revised and upgraded.

The Ministry provides support for mine safety associations active in the province. These associations were organized to help promote mine rescue and first aid. Association members consist of representatives from this section, the Workers' Compensation Board, the St. John Ambulance Association, suppliers and industry. The associations sponsor safety competitions under simulated disaster conditions, which serve to extend the members' skills in protecting themselves, mine property and other lives. These competitions are serious challenges which provide practical experience. Competitions begin at the local level. Winners in various zones compete in provincial competitions and the winning team is sent to the national Canadian Underground Mine Rescue Competition. Mine rescue training in British Columbia is considered to be of exceptionally high quality. Competitors from this province consistently placed in top positions at interprovincial and international competitions held during 1980-1982.

Environmental Control Section

The Environmental Control Section is responsible for testing and maintaining safe atmospheric working conditions at mining operations. Staff members inspect and monitor dust, other airborne contaminants, ventilation, noise and radiation levels in mines. In addition, spot checks are made to determine levels of illumination at mine sites.

During 1980-1982, the section monitored and inspected most mining operations on a regular basis throughout the province. In instances of unsatisfactory conditions, the Ministry requested and received mine management cooperation in rectifying unsafe conditions.

Audiometric testing of mine employees for noise-induced hearing loss was continued regularly at most mining operations.

Twelve special radiation surveys for radon daughters and gamma radiation were also conducted.

Coal Section

The Coal Section is responsible for the orderly development of coal resources in the province and for safety during exploration, development and operation. Inspectors of Mines carry out routine inspections in their districts once per month, or as circumstances require. In addition, inspectors investigate accidents and dangerous or unusual occurrences.

The coal section examines all proposed underground and open-pit mining projects prior to approval of the mining system by the Chief Inspector of Mines. All submissions to the Coal Guidelines Steering Committee are also reviewed.

Increased interest in coal exploration and development by mining companies between 1980 and 1982 necessitated an increase in the number of inspection staff. This was accomplished in 1982 with the addition of one Inspector of Mines in Victoria and another in Prince George. At the end of 1982, the section staff was comprised of a Senior Inspector of Mines (Coal), three District Inspectors of Mines and two Inspectors of Mines.

A board of examiners, appointed by the minister under the *Coal Mine Regulation Act*, is responsible for the examination and issuance of statutory certificates under the Act. The Senior Inspector of Mines and a District Inspector are members of this three-person board.

Mining and Petroleum Roads Program

The Mining and Petroleum Roads Program provides funding under the *Ministry of Energy, Mines and Petroleum Resources Act* to construct and maintain various roads. This program encourages mineral and fossil fuel resource development by providing better access to areas of exploration activity.

Twenty-seven miles of all-weather road leading to the Sierra-Yoyo gas-producing area east of Fort Nelson was constructed in 1980. A total of $2,057,000 was provided for construction costs, with additional funds of $166,000 in 1981 and $186,000 in 1982 spent on maintenance. These maintenance funds provided fill for washed-out sections, extensive gravel work and repair to culverts.

Between 1980 and 1982 approximately $860,000 was spent in maintaining and upgrading the Omineca Road. This work included construction of bridges across Upper Lay Creek and Tenakihi Creek, and limited maintenance of the Takla Spur access road.

Approximately $223,000 was granted in 1980 and 1981 to nine smaller shared-cost projects for construction and improvement of access roads to mineral-rich areas. This shared-cost road grant program was discontinued in 1982 due to budgetary restrictions.

Geological Branch

The Geological Branch provides scientific expertise to the Ministry and the mining industry, to assist in the orderly development of the province's mineral resources. Information on the potential, quantity and distribution of mineral and coal deposits in the province is provided by the branch through geological mapping, construction of a resource data base, laboratory analyses and other studies.

To carry out this responsibility, the Geological Branch is organized into four sections: Geoscience Projects, Applied Programs, Resource Data and Analysis and the Analytical Laboratory.

Staff of the branch participate in numerous professional activities including scientific meetings and workshops, trade missions and professional associations. During 1980-1982, Geological Branch staff played major roles in organizing professional workshops attended by hundreds of industry, university and government geologists from across the country. The branch represented the Ministry and delivered scientific papers at conferences in France, Germany, South Africa and the United States. Members of the branch visited Japan and Korea in 1980 as part of a British Columbia trade mission on base metals.

Staff members have also been appointed to executive positions with the Canadian Institute of Mining and Metallurgy, the Geological Association of Canada, the Canadian Geoscience Council, the B.C. Association of Professional Engineers, the Chemical Institute of Canada and the advisory committee to the Geological Survey of Canada.

A series of publications and maps present the work of the branch to industry and public. Yearly publications include *Geological Fieldwork* and *Exploration in British Columbia*. Mapping issued by the branch includes: Regional Geochemical and Aeromagnetic Surveys, Mineral Deposit/Land-Use Maps (Mineral Potential), Mineral Inventory Maps, Assessment Report Index Maps and a series of Preliminary Maps. A revised and updated output of MINFILE data was made available in 1981 and 1982. The branch also presents many of its geological studies in articles published in scientific and technical journals and maintains a substantial field and laboratory program.

Geoscience Projects Section

Geoscientific mapping, surveys and related research is provided by the Geoscience Projects Section in order to stimulate and facilitate effective exploration and production of provincial mineral and coal resources. In the course of its work, the section accumulates geological expertise useful in advising government agencies and the mining industry. The exploration industry has a particularly critical need for the products of field mapping and related research produced by the section. Regional geochemical reconnaissance surveys, jointly funded by the federal and provincial governments and conducted by the section with the help of the Analytical Laboratory, have been effective for both exploration and environmental baseline studies.

Major projects and commodities studied by the section during 1980-1982 include:

1980

- North Okanagan Tertiary stratigraphy and paleomagnetics (U, Au, Ag);
- Southeast British Columbia lead and zinc resources, Moyie Lake and Revelstoke areas;
- Barriere Lakes/Adams Plateau (Cu, Pb, Zn, Ag, Au);
- Clearwater area (Cu, Pb, Zn, U, Au, Ag);
- Sicker Group (Cu, Zn, Au, Ag), continued in 1981 and 1982;
- Northeast British Columbia lead and zinc resources, Akie River area, continued in 1981;
- Cassiar area (Mo, W, Au), continued in 1981;
- Correlation of Lower Cretaceous stratigraphy and coal beds in Peace River area.

1981

- Toodoggone volcanic area (Au, Ag), continued in 1982;
- Gravity survey of Tulameen Coal Basin;
- Coquihalla Ultramafic Belt gold deposits, continued in 1982;
- Tertiary Intermontane Basin - energy and mineral resources.

1982

- Geological studies of the Kimberley area and the origin of its lead-zinc-silver resources;
- Geology and magnetostratigraphy of Miocene basalts, Okanagan area;
- Mosquito Creek mine (Au), Cariboo gold belt;
- Northern British Columbia, massive sulphide deposits;
- Stewart area, precious metal resources.

Geological studies conducted principally by the section's project geologists were often augmented with work by the district geologists and laboratory scientists of other branch sections. Reports on projects undertaken and properties examined by the geologists are reported yearly in *Geological Fieldwork*.

Regional geochemical surveys, jointly funded with the Geological Survey of Canada and covering about 57,000 square kilometres of central and southern British Columbia, were conducted under a series of contracts supervised by the branch in 1980 and 1981. The 1980 surveys included the Quesnel and Quesnel Lakes area. Hope, Ashcroft and Pemberton areas were surveyed in 1981.

Valuable geoscience studies were also conducted by professors and graduate students at several Canadian universities under grants provided by the Ministry in 1980 and 1981. These studies were often directly related to projects undertaken by the branch.

Applied Programs Section

The Applied Programs Section is responsible for monitoring and assisting the field activities of the mineral exploration industry. Geological information on the intensity and distribution of mineral exploration is provided by the section to government and industry for more orderly resource management. The section also offers technical aid and training assistance to prospectors, exploration personnel and developers.

Applied Programs are carried out by District Geologists operating from six district offices and from headquarters in Victoria. Their responsibilities include on-site examinations of mineral properties to assess mineral activities and aid in efficient land-use. District Geologists are also engaged in field research and mapping, and represent the Ministry on regional resource management committees.

Applied Programs research during 1980-1982 has included:

- field research on carbonatite-related deposits near Blue River;
- detailed field mapping of Elk Valley Coalfield;
- mapping of Crowsnest Coalfield at Fernie;
- coal quality studies in cooperation with B.C. Research and the University of Victoria.

Other geological fieldwork studies by District Geologists are described in *Geological Fieldwork*.

The section devotes a considerable amount of staff time to training prospectors. Between 1980 and 1982, hundreds of students were trained in basic prospecting and geology courses held at locations throughout the province. A two-week-long advanced mineral exploration course is held annually in the spring. The section is also responsible for the administration of the *Mineral Prospectors Act* and the related Prospectors' Grant Program. This funding has been responsible for the discovery of several substantial mineral deposits and the resulting exploration and economic activity. In 1982, funding of $100,000 for this program resulted in the support of 92 grantees who staked 1,500 claim units and signed more than $2.2 million worth of work commitments in option agreements.

Resource Data and Analysis Section

The Resource Data and Analysis Section compiles and interprets exploration and development data gathered on coal and mineral resources. This data provides an important source of information that allows government and industry to increase exploration efficiency. The section also helps ensure that mineral lands are properly managed and makes assessments of mineral potential on mineral-bearing lands before various land-use dispositions are approved. Most of the exploration industry information collected by the section is made available to the public after a one-year confidential period.

Major files compiled by the section include:

- Mineral Assessment Reports - over 7,900 microfilmed reports available at reader/printers in Vancouver and Victoria. Original reports are on file in Victoria and in the appropriate District Geologist office.

- Mineral Assessment Report Index - a computerized numerical index and alphabetical property index that is updated monthly and a map series that is updated semi-annually.

- MINFILE - a companion computerized information file for the Mineral Inventory Map Series. It includes summary description and bibliography on over 8,600 mineral sites and statistical data on mineral production and reserves.

- Property Files - open files containing published and unpublished reports, as well as historical maps on producers and prospects.

- Coal Assessment Reports - nearly 500 reports on coal exploration. Non-confidential files are available in Victoria.

- COALFILE - a computerized coal exploration data file.

- Mineral Deposit/Land-Use Map Series - a series of interpretive mineral potential maps.

- Industrial Minerals Inventory File - location, geological setting, size, quality and industrial applications for deposits of a wide range of commodities is available for inspection in Victoria.

- Index to Bedrock Geological Mapping - a list by NTS area, author and publication.

The section produces an annual publication entitled *Exploration in British Columbia* along with its update of MINFILE.

Section staff produce map compilations and mineral potential evaluations for land-use assessments. Site investigations for these assessments are made by District Geologists. Section staff are also involved in land-use planning programs such as those for South Moresby Island and the Slocan Valley.

Field-oriented studies on industrial minerals and structural materials were conducted by the section during 1980-1982. A major study of aggregate materials in the Lower Mainland was completed in 1980. A similar study of aggregates in other regions of the province was compiled in 1981. A geological and resource inventory of important silica and barite sources was conducted in 1982.

Analytical Laboratory

The Analytical Laboratory conducts a complete range of geochemical analyses in support of the projects conducted by District and Project Geologists of the branch. Laboratory staff provide analytical support for the Prospectors' Assistance Program and perform a limited number of free analyses for holders of a valid Free Miner's Licence. Some custom laboratory work is performed for various other government agencies. The laboratory is further responsible for certifying assayers in the province, and through this program controls the quality of work done by commercial mining assay laboratories. Semi-annual Certification in Assaying examinations were held by the laboratory during 1980-1982.

The laboratory is also responsible for quality control standards used in the regional geochemical program. The Chief Analyst directly assists in the administration of this program.

The facilities of the laboratory include: comminution and mineral separation equipment, X-ray fluorescence and atomic absorption equipment, gamma ray and emission spectrometric instruments and an X-ray diffractometer. The laboratory is also capable of performing traditional fire assay and wet chemical analyses.

A significant amount of method development and research was conducted by the laboratory between 1980-1882. Many of these studies were carried out in cooperation with the Geoscience Projects Section and numerous other government agencies. The studies included:

- distribution of minerals and supergene alteration of the Afton orebody;
- analysis of coal oxidation and liquefaction;
- monitoring of uranium in domestic water;
- new methods of determining gold in copper and molybdenum concentrates;
- development of trace element analysis by X-ray fluorescence;
- participation in interlaboratory standards program;
- measurement of low levels of gold in silts;
- a new method for determining barium in geological materials;
- the design and construction of an automatic sample changer;
- a field and lab study of the Tillicum Mountain gold deposit mineralogy;
- a critical review of data quality from the regional geochemical survey.

Mineral Economics Branch

The Mineral Economics Branch provides economic expertise that allows the Ministry to better formulate and plan mineral sector policy. The branch is currently organized into three main groups. Detailed statistics on provincial metal, coal, placer and other mineral production operations are collected and analysed by a mineral statistics group. An economic and financial analysis group conducts evaluations of mineral industry projects and government programs. Ministry and government incentive programs for industry, and tax and regulating policies are evaluated by a mineral policy group.

The economic and financial analysis group continued evaluation of new coal and metal projects during 1980-1982 to support the Ministry's new coal and metal mine approval systems. Using computerized financial and economic models, prospective coal and metal projects in several provincial regions were evaluated for cost-benefit analysis. Models used for this activity were refined and upgraded to reduce operating costs.

This group also carried out numerous research studies, and issued reports and submissions on a wide range of topics. In the period 1980-1982, these included:

- a major study of the molybdenum mining industry (1980);
- The Outlook for Barite Production in B.C. (1980-81);
- Mineral Sector Indicators for B.C. (1981);
- a detailed study of the 1981 operation costs of 20 major B.C. metal mines (1982);
- a study concerning taxation of coal mining projects in B.C. (1982).

The mineral policy group was organized in 1982. During that year it advised the Ministry on land-use and other regulatory policies and acted as liaison with the federal government on mining policy matters. The group participated in a task force on mining communities and prepared the provincial government's response to the federal mineral policy paper. Major studies by the group include:

- Action Plan on Strategic Regional Planning for Mineral Resource Development (1981);

- Common Interest and Potential Conflict Regarding the Slocan Valley Planning Program (1981);
- Outlook for Processing of Metallic Minerals in B.C. (1981);
- identification of mining projects suitable for participation in the federal New Employment Expansion and Development (NEED) program (1982);
- an overview of potential and existing mines in B.C. (1982).

Staff of the branch have continued to provide information on mineral policy and project planning to both domestic and foreign investors. Discussions have involved coal market potential and opportunities for processing minerals in British Columbia.

The mineral statistics group carried out monthly and annual assembly of all provincial mineral production data in the period 1980-1982. Staff members regularly consult with other government agencies to help streamline this process of collecting data. The branch began planning for computerization of the monthly metal mine surveys in 1980. The first phase of this computerization project was completed in 1981 and has led to greatly increased accuracy and timeliness of statistical reports.

Mineral Titles Branch

The Mineral Titles Branch, under the direction of the Chief Gold Commissioner, is responsible for administration of provincial laws and regulations relating to acquisition and maintenance of tenure for minerals and coal. Gold Commissioners and sub-recorders are appointed for 24 mining divisions throughout the province. Locations and all work on mineral claims and placer leases must be recorded at the Gold Commissioner's office in the division where the claim or lease is located.

Copies of recorded mineral claims are forwarded daily to the Chief Gold Commissioner's office in Victoria; information concerning claims and leases can be obtained from this office, from the division where the property is located, or from the Mineral Titles office in Vancouver which maintains a duplicate record system.

Maps and records showing approximate positions of mineral claims may be viewed by the public at the Gold Commissioners' or Ministry offices. Prints of titles maps for the entire province may be obtained in Victoria and Vancouver.

In 1980, the branch received 3,007 applications for placer leases in designated placer areas. With the reduction in world gold prices, applications dropped to 2,445 in 1981, and were down to 1,441 in 1982. There were 112 requests for designations of additional placer mining areas during this period.

Applications for titles may be checked by Mineral Claims Inspectors based in Kamloops, Smithers, Vancouver and Nelson. These inspectors correlate the location of mineral claims with their recorded positions and determine the validity of the staking. This service helps provide claim-holders with firm title to their claim. Inspectors also investigate disputes and possible misuse of mineral claims. Sixty-one mineral claims were cancelled between 1980 and 1982 as a result of 87 complaints under the *Mineral Act*.

Also in the branch, the Coal Administrator is responsible for reviewing applications for coal licences and leases and maintaining and recording coal titles records.

PETROLEUM RESOURCES DIVISION

The Petroleum Resources Division is responsible for all matters related to Crown-owned petroleum and natural gas rights in British Columbia. The division supervises the disposition of these rights and regulates all exploration, development and production operations of the oil and gas industry.

The Petroleum Resources Division is divided into four branches. The Engineering and Operations Branch regulates drilling and production operations of the petroleum industry. The Geological Branch provides geological surveillance of petroleum exploration and development. The Titles Branch manages the disposition of petroleum and natural gas rights and maintains the permits, leases and licences required to record the petroleum industry's title to oil and gas resources. The Offshore Administration Branch was established in 1981 to develop and coordinate policies concerning offshore oil and gas activities.

The period 1980-1982 saw the petroleum industry in British Columbia go from extremely high levels of activity to a general overall slowdown. The petroleum industry report which follows chronicles the decline and outlines the Ministry's relationship to the industry during these three years.

The Petroleum Industry 1980–1982

In the early months of 1980 the petroleum industry was operating at record levels in British Columbia. That situation changed in 1981. The economic downturn that began in late 1980 and continued through 1982 severely reduced world petroleum prices. All aspects of oil and gas exploration in the province were affected by adverse economic factors. Export markets for natural gas decreased considerably, largely due to the high Canadian border price for gas exports. The industry found that returns on drilling and production activities often did not justify continuing operations. The industry also considered government wellhead pricing and the federal tax regimes introduced as part of the National Energy Program as factors that contributed to their economic problems.

Steps were taken by the British Columbia government to help rectify those factors under its control. The British Columbia/Canada agreement on prices reached in September, 1981 helped standardize the petroleum pricing formula. Proposals for the future manufacture and export of liquefied natural gas, petrochemicals and fertilizers were supported by the government. A study group was also organized to review the natural gas marketing system in British Columbia, and recommend financial and institutional changes required to stimulate gas sales and other industry activity. It would, however, be overly optimistic to presume that short term government action is capable of solving all the petroleum industry's economic problems or stimulating export sales.

Exploration and Development

Drilling activity reached an all-time high in 1980, then declined dramatically in 1981 and 1982. Marketing and pricing factors resulted in decreased cash flows to operating companies. Drilling efforts were limited to commitment wells, deliverability wells to protect existing contracts, and oil wells which provide immediate additions to cash flows.

There were 383 wells drilled in 1980 compared to 211 in 1981 and 108 in 1982. Well authorizations issued dropped 53 per cent in 1981 and a further 53 per cent in 1982. Oil wells were completed at generally stable levels over these three years, but gas

TABLE 3

VALUE OF PRODUCTION

	1980 $	1981 $	1982 $
Crude oil	189 561 479	235 559 762	333 892 930
Field condensate	3 489 431	3 224 675	3 337 069
Marketable natural gas	612 545 107	620 423 303	542 664 470
Gas plant liquids	22 706 609	28 388 606	33 008 086
Total	**828 302 626**	**887 596 346**	**912 902 555**

PROVINCIAL REVENUE FROM THE PETROLEUM INDUSTRY

	1980 $	1981 $	1982 $
Rentals and fees	27 809 527	27 334 016	31 126 284
Crown reserve dispositions	181 266 804	60 776 403	16 724 133
Royalties (oil, gas and products)	49 369 549	55 640 158	76 180 767
Gas revenue from B.C.P.C.	242 875 000	158 000 000	155 000 000
Total	**501 320 880**	**301 750 577**	**279 031 184**

completions declined 54 per cent in 1982. Drilling operations were completed at two geothermal wells in the Meager Creek area in 1982. The geothermal potential of these wells is being investigated.

The most active drilling concentrations between 1980 and 1982 were in the Fort St. John area where drilling activity attempted to extend established oil reserves. Many successful wells drilled in 1982 qualified for the New Oil Reference Price (NORP) under the federal/provincial Petroleum Incentive Program (PIP).

Exploratory drilling declined from 241 wells in 1980 to 149 wells in 1981 and 64 wells in 1982. Successes during 1980-1982 are classified as: 10 new pool oil discoveries, 172 new pool gas discoveries, and 77 outpost completions to established pools.

Development drilling also declined in this period. Forty-five development wells were drilled in 1982 compared with 62 wells in 1981 and 144 wells in 1980.

Geophysical seismic activity was also down considerably. From a high of 467 crew-weeks in 1980, geophysical activity dropped to 281 crew-weeks in 1981 and down to 112 crew-weeks in 1982.

Field Activity

There were no uncontrolled petroleum well blowouts during 1980-1982; however several controlled blowouts worthy of mention did occur. A Shell W Sierra gas well was closed down in 1980, but was subsequently completed. A blowout at a Wainoco well in 1980 allowed gas to escape; the gas was flared off and circulation regained. A Quasar N Grizzly well was flared to relieve high surface pressure and the well was later returned to production status in 1980.

In 1982, several drilling breaks occurred at a Remington Sikanni drilling site, but the flow was diverted to a flare pit and successful killing operations were conducted. Highly pressurized salt water was released during an incident at a Boundary Lake drill site in 1981. The water was later disposed of successfully into the waterflood system before any damage was caused. Another incident occurred at Remington S Grassy when severe lost circulation was encountered in 1982. Material pumped into the well to restore circulation found its way to the surface, but no serious environmental problems were created.

Several oil spills and production equipment fires occurred between 1980 and 1982. Extensive fire damage was done to a dehydrator building at a Woods Wainoco Monias site in 1980. Five hundred cubic metres of oil was spilled at the Suncor Blueberry main battery in 1981, but cleanup operations were easily made. A second spill of about 30 cubic metres occurred at the Norcen Eagle battery site that year.

A fire at the Suncor Blueberry d-92-L battery in 1981 caused one worker to suffer minor facial burns and possible hearing damage. A second major fire in 1981 closed down a site at a Norcen Eagle battery. In 1981, oil spills at the Norcen pipeline and at an Amoco Inga site were both recovered. A Texaco dehydrator fire in 1982 completely destroyed the unit when a 1/4-inch test plug failed. A subsequent investigation prompted Texaco Canada Resources to inspect all dehydration units in service for faulty or leaking test plugs.

Major battery modifications were completed to the Kildonan Buick Creek battery in 1981. Four wells and a battery were shut down in 1979 after a leak of oil and toxic hydrogen sulphide-bearing gas. The division specified extremely stringent requirements for the new operation to protect the nearby Blueberry Indian Band Reserve. Inverness Petroleum tied one of their wells into this battery in 1982 after an equally close safety inspection of the facility by the division.

Production

While exploration levels dropped during 1981 and 1982, oil production showed a modest increase. Producing oil wells rose to 633 in 1982 from 591 in 1981 and 588 in 1980. Boundary Lake continued to be the province's largest producing oil field. The Eagle field was the only major oil field to record increases over the three consecutive years of 1980-1982.

Declining strength in the export market to the United States caused decreases in raw gas production. From 1980 levels, gas production dropped 6.8 per cent in 1981 and a further 7.3 per cent in 1982.

During 1980-1982 the Ministry approved 12 applications from industry to convert wells to salt water disposal service. Numerous applications for good engineering practice (GEP), concurrent production for oil and gas, and downhole co-mingling of gas production were also approved after inspection by Ministry staff.

Industry submitted six common purchaser applications to the B.C. Utilities Commission to have the B.C. Petroleum Corporation declared a common purchaser of natural gas at various gas pools in the province. Ministry staff assisted the commission by conducting cross-examination of applicants concerning technical evidence presented at public hearings. Recommendations were made to the commission concerning the disposition of the applications.

Two applications for new oil royalty rates on incremental oil production were approved with agreement of the Mineral Revenue Branch. Royalties on total production are levied at the old price until a specific volume of oil has been produced.

Applications were also approved for various waterflood operations and gas conservation schemes over this three year period.

Land Disposition

There were seven dispositions of Crown reserve petroleum and natural gas rights held in 1980, with an additional seven held in 1981 and five held in 1982. The following chart lists the details of these dispositions:

	Parcels Offered	Parcels Disposed	Total Hectares	Tender Bonus $	Average Price per Hectare $
1980	735	558	441 297	181 266 804	401.76
1981	443	316	599 208	60 776 403	101.43
1982	169	123	166 441	16 724 133	100.48

Note: The 1981 figures include nine parcels covering 283 014 hectares of petroleum and natural gas rights on the Queen Charlotte Islands which were disposed of for an average price of $0.18 per hectare.

Engineering and Operations Branch

The Engineering and Operations Branch is responsible for providing Ministry supervision over the operational activities of the petroleum industry. The branch is divided into three sections.

The Development Engineering Section licences drilling and service rigs, issues well authorizations and maintains detailed records of all drilling and production operations. The Reservoir Engineering Section determines production capabilities of reservoir pools and sets oil and gas allowable rates. The District Office represents the division in the field to provide enforcement of drilling and production regulations.

The branch upheld a heavy technical and regulatory workload during the active period of petroleum drilling in 1980. With the decrease of drilling activity during 1981 and 1982, the regulatory requirements of branch staff were reduced. However, important activities referred by other ministries and agencies were increased considerably. These included: advising the B.C. Utilities Commission during common purchaser hearings; close involvement in projects with the Energy Division; and participation in the Commissioner Inquiry on British Columbia's Requirements, Supply and Surplus of Natural Gas and Natural Gas Liquids. Continuing work was done in the branch to eliminate problems arising from overlapping government agency regulatory responsibilities.

The branch also continued progress on several important studies including: modernizing of blow-out prevention regulations, a review of depletion of water-driven gas pools, an update of drill-site accessibility maps and a review of the provincial oil-producing capability. Branch staff also became familiar with the technical aspects of geothermal resources drilling and production operations, now developing as a new potential energy source for the province.

Development Engineering Section

Major responsibilities of the Development Engineering Section include administering matters related to location, drilling, completion and abandonment of petroleum and geothermal wells. This involves assuring that all well operators conform to Ministry regulations and submit the required applications and information to

the branch. Well authorization approvals are granted by the section to proposed well locations after review and reference to the Titles and Geological Branches. There were 369 well authorizations issued in 1980 to drill new locations, 174 in 1981, and only 82 in 1982.

All drilling and service rigs operating in the province must have a valid rig licence. In 1980, 98 were renewed and 42 new ones issued. In 1981, 68 were renewed and 14 new ones issued. Eighty were renewed and nine new ones were issued in 1982.

Every three months, field and pool outlines are determined and circulated to the industry. Descriptions of these outlines are based upon geological interpretations made by the division staff.

In addition to comprehensive well data records, the Development Engineering Section maintains all geological and geophysical reports submitted for work credits. Division correspondence files for the three Petroleum Resources branches are also kept. The program of using government facilities to microfilm the library containing British Columbia well data was abandoned in 1980 because of poor reproduction quality. Division staff now use a microfilm library produced by a commercial service company. This library is supplemented by a set of logs taken from British Columbia wells and other important nearby wells.

A long-term project was undertaken in 1980 to rewrite and modify the computer system that generates monthly petroleum production reports. The initial work was discontinued before any results were obtained when the computer system was found to be too costly. A more comprehensive and cost-effective system will be phased into operation in its place. This system will include calculations of royalties and other accounting features and will be done in cooperation with the Mineral Revenue Branch, which is responsible for the collection of royalties. The production reports will be reorganized to provide greater capability to analyse financial data.

The section also began two long-term studies in 1982. The first study was initiated to determine the oil production capability of the province and indicate the production efficiency of each pool. Consultation with drilling operators over the results of this study should lead to increased recoveries of petroleum. A second long-term study was initiated to review the methods by which the flow of British Columbia gas is reported and measured in the field.

Developments initiated by the federal government brought additional administrative duties to the section in 1982. The section now assists in the admininistration of the New Oil Reference Price (NORP) and the Petroleum Incentives Program (PIP). These programs are financial concessions that encourage both greater development as well as increased Canadian participation in the petroleum industry.

Reservoir Engineering Section

The Ministry's ongoing estimations of the oil and gas reserves in British Columbia are made by the Reservoir Engineering Section. Established estimates as of December 31, 1982 are summarized as:

Oil, established	24 205.9	10^3m^3	(152 324.6 MSTB)
Natural gas etablished:			
Raw	297 766	10^6m^3	(10 568.8 BSCF)
Marketable	242 699	10^6m^3	(8 614.3 BSCF)
Natural gas liquids:			
Propane	1 533.5	10^3m^3	(9 661.0 MSTB)
Butane	2 262.0	10^3m^3	(14 243.5 MSTB)
Pentane plus	4 359.9	10^3m^3	(27 436.3 MSTB)
Sulphur	11 430.0	10^3t	(11 249.4 MLT)

Note: *MSTB = thousand stock tank barrels*
BSCF = billion standard cubic feet
MLT = thousand long tons
10^3m^3 = 1 000 cubic metres
10^6m^3 = 1 000 000 cubic metres
10^3t = 1 000 tonnes

During 1980-1982, the Reservoir Section prepared detailed submissions to the Commissioner Inquiry on British Columbia's Requirements, Supply and Surplus of Natural Gas and Natural Gas Liquids. These reports contain estimates of currently established reserves and future additions, present and future producibility of established reserves and ultimate potential reserves of gas and natural gas liquids. Estimates were made for both shallow- and deep-cut conditions of gas processing.

The 1980 gas and crude oil producibility forecasts were included in provincial submissions to the National Energy Board hearing on energy supply and demand. It was estimated that producibility from gas reserves established by 1980 would only meet domestic and export demand through 1983. Established oil reserves were currently meeting only 25 per cent of provincial requirements.

The 1982 studies concentrated on the quantity of natural gas reserves exceeding provincial requirement, located in the Western Sedimentary Basin of northeastern B.C. Economic considerations were also applied to pool size distribution data to estimate the ultimate commercial potential for reserves of hydrocarbons in the offshore portion of the Queen Charlotte Basin.

The section has continued to investigate techniques which may be used to extract previously unobtainable tertiary oil reserves. One proposal received from industry in 1980 was later withdrawn when laboratory tests indicated the technique had an unusually high chemical requirement which made the project too costly.

A consultant study was made in 1981 to investigate the economics of a carbon dioxide miscible flood in Boundary Lake Unit No. 1, the province's largest oil pool. The study indicated that the technique would increase oil recovery 50 per cent over present recovery, but the increased costs of infill drilling and carbon dioxide transportation would still not make the project economically attractive at current prices.

In 1982 a task force of Ministry staff and engineers from three major oil producers was established to investigate financial incentives required to implement the Boundary Lake study. To technically assist the task force, the division conducted a laboratory study of the miscibility of carbon dioxide and oil. It was independently concluded by all members that this technique would still not be economically feasible under either existing taxation structures or the forecast future price of oil.

Drilling and Production Section (District Operations)

Field level enforcement of Ministry petroleum regulations is provided by the District Office at Charlie Lake in the Peace River area.

While petroleum drilling proceeded at record levels in 1980, a steady decline in drilling activity during 1981 and 1982 shifted the emphasis of district staff responsibilities. Production-oriented work was given priority over drilling inspection activity. During 1982, 312 inspections were performed at drilling well sites compared with record levels of 600 to 700 inspections made in previous years.

Production engineering operations were stepped up to ensure compliance with environmental requirements and gas conservation orders. Good engineering practices were more closely monitored at oil and gas production facilities. Inspections at these sites increased from 439 different occasions in 1980 to 582 in 1981 and 1,353 in 1982.

To confirm the reliability of subsurface pressure data supplied to the Reservoir Engineering Section by industry, 5,560 calibrations were performed by district staff on oil and gas production pressure gauges between 1980 and 1982. The standard British Columbia Dead Weight Tester used to monitor these gauges is annually checked against its Alberta counterpart to maintain acceptable limits of accuracy. During 1980-1982 an additional 221 static pressure gradients were run, with 161 oil and 82 gas well tests witnessed.

The reliability and accuracy of gas measurement equipment was also monitored during this period, with fast meter checks made on 1,630 additional occasions.

The District Office manager continued to serve as co-chairman of the Northeastern British Columbia Oil Spill Cooperative. In 1981, this organization's annual OSCAR (Oil Spill Containment and Recovery) exercise involved simulating a real oil spill in an area inaccessible by road. Peat moss and edible vegetable oil placed into the Beatton River was successfully recovered with booms and skimmer pumps lifted in by helicopter. In 1982, the exercise involved deploying a river boom from a steel cable strung across the Peace River just downstream from a controlled flow of edible oil. The exercise was the first time that a river boom was successfully deployed using the cable technique in a cleanup of a major river. The Oil Spill Cooperative was also directly involved with the cleanup of an actual but minor oil spill in June, 1981. The spill site was adjacent to a recreational area and cleanup operations were conducted immediately. Cleanup costs incurred by the cooperative were reimbursed by various oil trucking firms in the area.

The section continued its membership in the Blow-out Prevention Certification and Examination Committee. During 1980-1982, government and industry representatives met to standardize interprovincial blowout prevention systems. A program to certify the well servicing industry and a set of standards for sub-sea operations were also developed by this group.

The maps and materials which define northeastern B.C. areas accessible for drilling during summer months were updated in 1981. Road systems built by the Ministry were a major factor in the upsurge of gas field drilling in this area. The roads also provide accessibility to the area in the event of mishap.

The District Office has been instrumental in drafting revisions to regulations covering electrical standards for drilling rigs. Air pollution and environmental standards for drilling and production activities were also revised during 1980-1982.

The petroleum industry has cooperated in successful programs of soil reclamation, fertilization and seeding of areas where minor oil spills have occurred.

Geological Branch

The Geological Branch is responsible for collecting geological information on the petroleum and geothermal resources in the province. This geological and geophysical data helps develop procedures which ensure better conservation and returns from limited resources. Branch staff make estimates on the potential of undiscovered resources and provide advice that assists petroleum industry exploration and development activity.

The branch consists of three sections. The Economic Geology Section coordinates projects that assess the potential petroleum and geothermal resource base. The Reservoir Geology Section makes detailed geologic evaluations of oil and gas reservoirs.

A Geophysical Section was formed in 1982 to integrate geophysical data with available geological work and provide technical opinion on geophysical matters. Staff from this section provide geophysical input from assessment reports to the regional subsurface mapping program, and assist the projects conducted by the Economic Geology Section. These projects require estimating provincial hydrocarbon potential, evaluating geothermal resource centres and assessing land-use proposals. The section also provides input to various government and private proposals for petroleum exploration activity.

Economic Geology Section

The Economic Geology Section is responsible for coordinating projects that estimate the province's potential undiscovered petroleum and geothermal resources. Staff geologists maintain and update a master map series of subsurface rock formations found in the province.

The drillstem penetration mapping series is composed of 35 map sheets, and shows for all wells outside designated field boundaries: the deepest geological formation penetrated, all formation drillstem tests, and the zone or zones in which gas and oil wells are completed. Within designated field limits, the penetration map shows drillstem tests in horizons other than that productive in the field, as well as the formation at total depth for wells which have penetrated below the lowest productive horizon within the field.

In 1980, stratigraphic cross-sections of the Triassic Charlie Lake formations were published and were immediately put to use by industry. A map of the province showing the location of all known thermal springs was published in 1982 as an overlay to a generalized geological map of the Canadian Cordillera. The Jean Marie map series, a regional study started in 1980, was also published in 1982. This series is particularly useful in computation of future undiscovered gas resource figures.

The computation of future reserves was a continuing process during 1980-1982. Estimates of reserves are used in the evaluation of supply possibilities for future marketing demands.

In 1980, a cursory review of the Fernie Basin geology was made in view of the resumption of industry activity in the area. Also, discussions were held with staff of the Geological Survey of Canada and the Pacific Geoscience Centre regarding British Columbia's hydrocarbon potential offshore. While the lack of factual offshore subsurface data contributes to the low estimate of the area's potential resources, an open file is maintained in the event that interest in the area revives. Oil shale deposits in the Queen Charlotte Islands were also studied in 1982, and while the oil shale potential is encouraging, further investigation is necessary.

A review of data on provincial geothermal resources was begun in 1980 as a preliminary step to the development of new legislation. While geothermal energy appears to be costly, it may prove in time to be a valuable addition to the overall energy resources of the province. In 1981, the *Geothermal Resource Act* was prepared and placed before the legislature. Considerable interest in the resource was expressed by industry, and several meetings to discuss the content and intent of this Act were held during that year. The *Geothermal Resources Act* was proclaimed in 1982, with preparation for the first offering of geothermal rights in process by year end. Three deep holes drilled by B.C. Hydro in 1982 at Meager Creek encountered a geothermal anomaly which will produce steam. Further programs for exploration or development have yet to be decided.

Discussions with representatives of various companies were continued during 1980-82 regarding proposals for, and problems with, exploration in the province. These proposals included Vancouver Island and Fraser Valley gas deposit projects and the Mount Cayley and Tumbler Ridge geothermal prospects.

Reservoir Geology Section

The Reservoir Geology Section carries out a comprehensive program of assessment and detailed mapping of all oil and gas accumulations encountered by drilling. Structural, stratigraphic and reservoir geologic data discovered by drilling is used as a

basis for new and revised map constructions. This data is further used in reservoir studies and evaluations of reserves. The data assists in the control of production rates, repressuring, cycling, remedial work and secondary recovery projects.

While the petroleum industry continued high levels of drilling activity in numerous fields in 1980, drilling activity moderated considerably in 1981. In 1982 there was a further 50-per-cent reduction in drilling activity. There were no areas in the province of concentrated drilling development in 1982. Twenty new fields encompassing single or multiple well pools were designated in 1980, while only five new fields were designated in 1981 and no new fields in 1982.

All field and pool limits were revised quarterly when necessary. Field and pool designations often have a significant impact on well confidentiality, lease tenure, royalty rates and wellhead prices paid for production.

There was minimal controversy with industry between 1980 and 1982 regarding parameters used for calculating well allowables. Nine Common Purchaser or 'drainage' submissions were evaluated. Section staff served as technical advisors at hearings held by the British Columbia Utilities Commission over these submissions. In 1982, technical data and advice were given to the Commissioner Inquiry on British Columbia's Requirements, Supply and Surplus of Natural Gas and Natural Gas Liquids.

Several major lithologic studies were initiated between 1980 and 1982 to determine the continuity extent of hydrocarbon reservoirs in the province. The major areas studied included: the gas-productive Jean Marie carbonate, the Cretaceous and Mesozoic sands in the Deep Basin and the oil-productive Belloy at Stoddart and Stoddart West.

In September, 1981, the New Oil Reference Price (NORP) agreement was signed by the province and the federal government. The Reservoir Geology Section issued a series of oil pool boundary plats which outlined the areas designated by the agreement and defined the wells eligible for the new prices. In 1982 a further series of boundary plats was completed and published to designate gas wells qualified to receive the NORP qualifications for liquefied gas production.

The Reservoir Geology Section continued to provide routine advice and assistance to other Ministry branches. The section carried out geological evaluation and assessment of Crown lands posted for disposal of petroleum and natural gas rights. Further assessments were made for petroleum and natural gas lease extension renewals. The reclassification of wells for the purposes of confidentiality and new pool discovery status were also provided by the section. Appraisals of industry production schemes were made covering good engineering practices, concurrent production, the disposal of surplus mud and the disposal of water production.

Titles Branch

The Titles Branch is responsible for administering laws and regulations affecting the title and disposition of Crown petroleum and natural gas rights including any approved underground storage programs.

The branch **Lease Records Section** issues all petroleum and natural gas permits, leases and drilling licences. The section records transfers of title and encumbrances, and approves geophysical licences, notices of commencement of exploratory work, affidavits of work and unit agreements.

The **Accounting Section** collects and accounts for all petroleum and natural gas revenue payable to the Crown, with the exception of royalties and natural gas sales revenues.

The **Draughting Section** prepares and continually updates the titles and dispositions maps of the branch. The section also handles mapping of roads and trails for seismic and petroleum development activity.

A hectic pace of activity by the branch during 1980 slowed down between 1981 and 1982 as oil and gas exploration began its downward trend. The number of natural gas and petroleum rights dispositions held in 1982 dropped to five, from the seven held during each of 1980 and 1981. A total of 169 parcels of exploration rights were offered in 1982. Of these, 123 were awarded. This figure compares to 443 parcels offered and 316 awarded in 1981 and 735 parcels offered and 538 awarded in the 1980 calendar year.

The tender bonuses received during 1982 amounted to just under $17 million compared with $60 million received in 1981 and $181 million received in 1980. The 1982 tender bonus total was the lowest amount received since 1975.

Geophysical exploration programs increased by 54 per cent in 1980. This increase was followed by an equally significant 70-per-cent decline in programs approved in 1982. There were almost 20,000 kilometres of seismic line shot and recorded during 1980. This amount decreased to about 10,000 kilometres in 1981 and to just over 4,000 kilometres in 1982.

As the result of an amendment to the *Petroleum and Natural Gas Act* in 1981, the drilling reservations form of title was phased out. A new form of title known as a 'drilling licence' was initiated in January, 1982.

As of December 31, 1982, there were 11,664,169 hectares of oil and gas rights in the province held under 8,221 various forms of title.

Offshore Administration Branch

The Offshore Administration Branch was established in March 1981 to ensure a strong provincial position in the management and development of offshore resources. The Inland Marine Zone was declared in June, 1981 and a provincial moratorium was placed on offshore petroleum activity pending public hearings, with an indefinite moratorium south of Telegraph Cove in Johnstone Strait and the Straits of Georgia and Juan de Fuca.

Branch efforts were focused on: negotiating strategies, support for the province's case in the Georgia Strait reference appeal to the Supreme Court of Canada, initial discussions concerning provincial management priorities, revenue sharing, environmental management and onshore effects. Developments in other provinces and actions taken by the federal government were also monitored.

A public information program was initiated in 1981. A major conference on westcoast offshore petroleum opportunities and expectations was organized in cooperation with other government agencies, industry and representatives of the public. Communication with community interest groups, and liaison with federal and provincial agencies with an interest in the offshore industry were also maintained.

Mediation and Arbitration Board

The Mediation and Arbitration Board is established under the *Petroleum and Natural Gas Act* to facilitate negotiations between petroleum companies and British Columbia landowners regarding access to petroleum-bearing lands. The board has the responsibility and authority to:

- grant Right of Entry to oil and gas companies over lands where the landowner has refused access;
- determine the conditions for Right of Entry and establish compensation to be paid to the landowner;
- appoint a member of the board to act as mediator between a petroleum company and a landowner when an impasse develops regarding Right of Entry;
- convene an arbitration hearing, if mediation proves unsuccessful, where evidence and exhibits can be received from landowners and petroleum companies before compensation for Right of Entry is determined regarding wellsite, campsite, roadway and/or pipeline installations;
- conduct arbitration hearings, when requested, to review and set annual rental on leases and previous board orders of more than five years duration;
- terminate Right of Entry when a petroleum company ceases to occupy land and a Certificate of Restoration has been issued by the Ministry;
- amend or rescind board orders as circumstances and conditions dictate.

In 1982 the board was assigned the same statutory responsibilities under the *Geothermal Resources Act* as provided under the *Petroleum and Natural Gas Act* regarding Right of Entry upon alienated lands.

During 1980-1982, the board issued 31 Right of Entry orders and settled 40 situations of disagreement between petroleum operators and farmers by mediation. Field surveys and on-site inspections were conducted to support the mediation and arbitration process. A full-time office was established to meet a growing demand for the board's services and allow it to handle an increased number of arbitration hearings.

A booklet was published in 1981 containing information to assist both petroleum companies and landowners in negotiating private settlements regarding access rights and compensation. This booklet is available from the Ministry or the office of the Mediation and Arbitration Board.

FINANCE AND ADMINISTRATION DIVISION

The Finance and Administration Division is responsible for providing financial management, personnel and other administrative services in support of the Ministry's policies and programs. It also manages the assessment and collection of taxes and royalties prescribed in a variety of legislation administered by the Ministry.

The division is divided into five branches.

The Financial Services Branch provides financial management services in support of all Ministry programs.

Personnel Branch looks after recruitment, selection, classification and labour relations requirements for a staff which includes a relatively high number of professional engineers, geologists and economists.

The Administration and Publications Branch is responsible for acquisition and management of office and other space requirements, field equipment and vehicles, and production of Ministry publications.

The Mineral Revenue Branch assesses, collects and accounts for major revenues arising out of taxes and royalties levied against the mineral and petroleum resource industries.

Data Services Branch manages a comprehensive program to further the use of data processing, office automation and management information systems in support of Ministry operations. With the advent of new computer technology, this branch is playing an increasingly important role in assisting other components of the Ministry to develop data storage and retrieval systems.

Administration and Publications Branch

The Administration and Publications Branch is responsible for acquiring and servicing Ministry property, including office space, vehicles, telecommunications and office support equipment. It also manages Ministry-wide mail and courier services.

Established in 1981, the Administration Branch was given responsibility for developing office automation and management information programs, with these functions being transferred to the Data Services Branch in 1982.

Also in 1982, the branch assumed responsibility for production and distribution of the many technical, administrative and public information publications produced by the Ministry.

The branch has led an ongoing program to reduce administrative costs throughout the Ministry. A central cost accounting program was developed to identify costs of all administrative services. Postal service incentive measures were implemented, radio telephone requirements assessed and a more cost-effective mobile radio telephone system developed.

In 1981, the Ministry vehicle policy was re-examined. An administration program was developed to more efficiently control repair and maintenance agreements, insurance coverage, and user need for vehicles in all regions. The first factory-built propane vehicles in the provincial fleet were acquired by the branch in 1982.

A Staff Safety Field Orientation Program was initiated in conjunction with Personnel Branch, upgrading occupational safety in Ministry offices and field operations.

The branch sent a representative to the Ministry of Labour's Women's Programs Advisory Group in 1982, resulting in establishment of a committee to provide a focal point for addressing women's issues within this Ministry.

A Publications Review Committee and a Price Review Board were established by the branch in 1982 as part of its new responsibility for Ministry publications, providing more cost-effective procedures and policies.

Financial Services Branch

The Financial Services Branch provides financial administrative support to all sections of the Ministry. It is responsible for preparing budget estimates, providing payroll services and administering all supplier accounts.

A great increase in general Ministry activity has expanded the volume handled by the branch. The monthly volume of items within the accounts payable and payroll sections has increased from an average of 30,000 items in 1980 to 48,000 items in 1982.

New regulations and directives under the *Financial Administration Act* have required the branch to introduce more extensive financial controls. A considerable amount of staff time is now spent in the preparation and monitoring of budget estimates and recording this information on the Interactive Estimate System.

In 1981, the branch placed a priority on developing a system of contract commitment control. This system, which provides more positive control of funds within specifically selected areas, was introduced in 1982.

Data Services Branch

Specialized support of Ministry information processing programs is provided by the Data Services Branch in accordance with a five-year strategic plan to implement Ministry-wide data processing operations. It is also responsible for developing office automation systems. The branch is the Ministry's prime interface with the services of the British Columbia Systems Corporation.

Data Services was restructured as a separate branch in 1981. During that year many of the Ministry's Honeywell data processing systems were converted to the IBM mainframe operating system of the B.C. Systems Corporation.

Development was started on a general-purpose geological plotting system for the Mineral Resources Division in 1981, leading to installation of equipment with special communications functions in 1982. The system allows field-collected geological data to be more quickly processed. Planning for computerization of Mineral Titles also commenced in 1982.

A system that updates many of the Petroleum Resource Division's existing statistical information systems was developed in 1981. The Petroleum Reporting System came on-line in June, 1982 with a facility for remote job and data entry. Work was also started in 1982 to automate all functions related to well drilling and production figures, which will facilitate reservoir engineers' use of valuable historical data when the system is installed.

Also under development for the Finance and Administration Division was an integral financial management information system using microcomputers. A financial accounting system, in conjunction with the Ministry of Finance, was installed as a pilot program.

The branch assisted the Energy Resources Division with its microcomputer-based econometric forecasting model and developed a program to more cost-effectively increase productivity and enhance research.

The branch also responded to numerous requests for enhancing existing systems, some of which have been upgraded to more sophisticated equipment where justified.

Mineral Revenue Branch

The Mineral Revenue Branch assesses, collects and accounts for mineral and petroleum taxes and royalties imposed under the *Mineral Resource Tax Act*, *Mineral Land Tax Act*, Coal Royalty Regulations and the Petroleum and Natural Gas Royalty Regulations.

As of September, 1981, the branch also began administering the Petroleum Pricing and Compensation Programs entered into under the Canada/British Columbia Agreement.

While a record revenue of $144.8 million was collected by the branch in 1980, collections fell by 26.7 per cent to $106.5 million in 1981, and dropped a further eight per cent to $98.4 million in 1982. The decline was mainly caused by depressed world markets.

A complete listing of all revenues collected by the branch appears in the report of Revenue to the Crown (page 10).

Personnel Services Branch

Personnel Services Branch provides the Ministry with support in selecting and recruiting the highly qualified engineers, scientists, economists and technicians needed to operate the programs of the Ministry.

The branch provides reclassification reviews for existing Ministry staff and proposed positions. A review of all Ministry positions under the Licensed Science Officer Plan was completed in 1980, with 42 appeals resolved by the branch in 1981. Classification requests increased dramatically through 1981 and 1982.

Personnel Services initiates training and safety programs for Ministry divisions. The branch also provides benefits and retirement advice to staff and deals with all labour relations issues.

Statistics on Ministry Personnel from 1980-1982

	1980	1981	1982
Permanent employees	312	329	345
Appointments	56	84	52
Temporary employees	38	63	51
Resignations	48	36	47
Retirements/pre-retirements	7	5	6
In-service transfers	20	18	12